DETAILED ACTION

Remark

- This Office Action is in response to applicant's amendment filed on March 5, 2008, which has been entered into the file.
- By this amendment, the applicant has amended claims 1, 2, and 6-9.
- Claims 1-14 remain pending in this application.

Allowable Subject Matter

1. The indicated allowability of claims 1-14 is **withdrawn** in view of the newly discovered reference(s) to Cuche et al (US. Pat. 6,626,818). Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. **Claims 1-14 are rejected under 35 U.S.C. 112, first paragraph**, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The specification and the claims fail to give adequate teaching as to what is considered to "processing the digitized hologram array" as recited in claim 1. Since the second method step is based on the "digitized hologram processed in the first step" (claim 1), so without the specific definition or description of the "processing the digitized hologram array" it is impossible to carry out the second step.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. **Claims 1-14 are rejected under 35 U.S.C. 112, second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The phrase "the holographic image sampling intervals" and the phrase "the digitized hologram array" recited in claim 1 each lacks a proper antecedent basis from earlier part of the claim.

It is not clear what is considered to be the "holographic image sampling intervals".

The phrase "processing the digitized hologram array" recited in claim 1 is confusing since it is not the "processing" is referred to what? Also what is this array?

It is not clear the discrete Fresnel transform is referred to what variables and to obtain what quantities? It is known that the discrete Fresnel transform is a mathematical function. A mathematical function generally takes certain variables to give certain result. This can be considered as transformation. However it is not clear what are the input variables that are being **transformed** by this discrete Fresnel transform. And it is not clear what is the result of the discrete Fresnel transform, furthermore it is not clear how does the result from the transformation relate to the reconstruction of the holographic image? The scopes of the claims are therefore really not clear since it is not clear the discrete Fresnel transform is transform between what and what?

The phrase "an array of Ve values" recited in claim 1 is confusing since it is not clear what is "Ve" and what are these Ve values?

It is also not clear what is considered to the integer "p" referred here? What is the physical meaning of the integer "p"? The applicant is respectfully noted that the discrete Fresnel transform is just an abstract mathematical function that does not have any PHYSICAL meaning by itself. Without specified the physical meaning of the discrete Fresnel transform and the variables recited and needed for the calculation, no physical values or meaning can be ascertained.

It is not clear what is considered to be "OS", since there is no definition for this symbol.

The phrase "p values are externally to said array of Vr values" recited in claim 3 is confusing since it is not clear what does this phrase mean?

The phrases "p values are arranged in a symmetrical way" and "p values are arranged in a non-symmetrical way" recited in claims 4 and 5 are confusing since it is not clear how p values are changed or arranged and with respect to WHAT are these values being arranged symmetrically or non-symmetrically?

The phrase "the digitized hologram is a square array of Vr=Nr*Mr values" recited in claim 7 is confusing since it is not clear the values are referred to what? The phrase "Nr and Mr each correspond respectively to a square pixel of sizes Δx and Δy" is confusing since it is not clear what is considered to be the "correspond"? The symbols "Nr" and "Mr" are most likely referred to **numbers** of the pixels comprised by the digitized hologram. The symbols "Δx and Δy" are referred to the size of the pixel so it is not clear what is the correspondence between the two?

The phrase "the x-axis" and the "y-axis" recited in claim 7 are confusing since it is not clear the axes are referred to what space and what plane? Image plane or plane contains the digitized hologram?

The square pixels "$\Delta\xi$" and "$\Delta\eta$" recited in claim 8 are confusing since it is not clear in what plane are these pixels defined and how are they different from the pixels referred by "Δx and Δy".

The phrase "the detected data" recited in claim 14 is confusing since it lacks proper antecedent basis from its based claim.

The phrase "apparatus for detection of holographic processing unit" recited in claim 14 is confusing since it is not clear what is considered to be ***detection*** of holographic processing unit?

The scopes of the claims are extremely unclear. The applicant is respectfully requested to clarify all the errors and indefiniteness to make the claims in comply with the requirements of 35 USC 112, first and second paragraphs.

Claim Objections

6. Claims 1-14 are objected to because of the following informalities:

(1). The phrase "the holographic image transformed in a digitized hologram" recited in claim 1 is better read as " the holographic image transformed **into** a digitized hologram".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Cuche et al (PN. 6,262,818).

The scopes of the claims are not clear for the reasons stated in rejection under 35 USC 112, second paragraph, the claims therefore can only be examined with the broadest interpretation.

Cuche et al teaches a method for *numerical reconstruction of holographic image* wherein a *hologram* (4, Figure 1) is generated by interference of illuminated light on specimen (or object) in a set-up (2), with the holographic image being *detected* by an *image acquisition system* (5) such as charge couple device (CCD, please see column 11, lines 40-50) serves as the *image detection device*. The detected holographic image is then *digitized* by an image digitizer (6) so that it is transformed into a digitized hologram (7).

Cuche et al teaches that the digitized hologram is an array $I_H(k\Delta x, l\Delta y)$ of Nx by Ny digitally encoded numbers which results from the two dimensional spatial sampling of the hologram intensity $I_H(x,y)$, (please see column 11, line 66 to column 12, line 36). This means the digitized hologram is an

array of elementary hologram pixels $I_H(k\Delta x, l\Delta y)$, with $(\Delta x, \Delta y)$ being the sampling spacing or interval along the x-axis and y-axis (or Ox and Oy axes) in the **digitized hologram plane**. It is implicitly true that there are a number of elementary hologram pixels such as Vr of them.

Cuche et al further teaches that the method for reconstruction of the holographic image is obtained by *numerically reconstructed* the hologram (please see Figures 1 and 4-5). The numerical reconstruction of the hologram involves the step of *computing* digital reference wave R_D, performing multiplication of the digital hologram I_H and digital reference wave R_D, and obtaining digital transmitted wavefront $\Psi_D(k\Delta x, l\Delta y)$ (Figure 4, could be identified as *processing the digitized hologram*) and then performing numerical calculation of the *scalar diffraction*. Or as in Figure 5, the numerical calculation of the scalar diffraction is directly performed on the digital hologram, (Figure 5). The *numerical scalar calculation* involves the *discrete Fresnel integral or transform*, (please see Equations 15-18, column 19 line 42 to column 20 line 33). The discrete Fresnel transform is to produce reconstructed wavefront $\Psi(m\Delta\xi, n\Delta\eta)$ (please see Figures 4 and 5) in the *observation* or *image plane*. The symbols $(\Delta\xi, \Delta\eta)$ are referring to the *sampling intervals in the observation or image plane* (please see column 17, line 53) and they are related to the sampling intervals $(\Delta x, \Delta y)$ in the digitized hologram plane by the following relationships:

$\Delta\xi=(\lambda.d_R)/(Nx\Delta x)$ and $\Delta\eta=(\lambda.d_R)/(Ny\Delta y)$,

with λ being the wavelength and d_R being the reconstruction distance and is equal to distance between the specimen or object and the detection device where the holographic image is detected (i.e. the hologram plane, please see Figure 2A and column 20, lines 38-55).

By these expressions the following expressions can be obtained,

$Nx=(\lambda.d_R)/(\Delta\xi\,\Delta x)$ and $Ny=(\lambda.d_R)/(\Delta\eta\,\Delta y)$, if $\Delta\xi=\Delta x$ and $\Delta\eta=\Delta y$, then

$Nx=(\lambda.d_R)/(\Delta x^2)$ and $Ny=(\lambda.d_R)/(\Delta y^2)$.

This reference has met all the limitations of the claims with the exception it does not explicitly identify the integer "p" and the "array Ve values", however the claims fail to disclose and define what are these symbols referred to, they really cannot be examined in details. These can only be regarded as the actual calculation techniques and steps with regard to the numerical calculation of the discrete Fresnel transform and since Cuche et al teaches explicitly to calculate the discrete Fresnel transform to obtain the reconstruction of the holographic image, such calculation techniques or steps are considered to be either implicitly included or an obvious modification to one skilled in the art to achieve the calculated result.

With regard to claims 10 and 11, the optimization process is implicitly included.

With regard to claims 12-13, Cuche et al teaches the reconstruction method is being carried out in a computer system, (please see Figure 12A).

With regard to claim 14, Cuche et al teaches that processing unit is included to process the detected holographic image and to calculate reconstruction of the holographic image from digitized hologram.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (9:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephone B. Allen can be reached on 571-272-2434. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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